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EXAMINER

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/536,494  
Filing Date: May 25, 2005  
Appellant(s): HOFFMANN ET AL.

\_\_\_Kristen J. Harrell\_\_\_\_\_

For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed on 3/06/08 appealing from the Office action mailed on 11/23/2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

|              |          |        |
|--------------|----------|--------|
| 6291633      | Nakamura | 9-2001 |
| 5786086      | Frihart  | 7-1998 |
| 2003/0126788 | Uang     | 7-2003 |
| 4680379      | Coquard  | 7-1987 |
| 4826951      | Coquard  | 5-1989 |
| JP05-12584   | Drawert  | 5-1993 |

## **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

#### **Issue I**

Claims 1-5, 7, 9, 11-18 rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US patent 6291633), herein Nakamura (cited in the previous Office Action), in combination with Frihart et al (US 5786086), herein Frihart (necessitated by Amendment) and evidences by Uang et al (US 2003/0126788, necessitated by Amendment).

Nakamura teaches semi-crystalline, melt processable copolyamides comprising terephthalic, isophthalic (Column 2, line 55), C6-C12 aminocarboxylic acids or lactams ((column 3, line 25), C6-C12 dicarboxylic acids (column 3, line 10), C4-C12 diamines (Column 3, line 5) with melting point from 290C to 316C (Abstract).

Regarding claims 14-18, Nakamura teaches different methods of producing molded articles from the above polyamide by extrusion (Example 11 ) and injection molding (Example 18).

Nakamura does not teach dimerized fatty acid in his polyamide.

Frihart discloses semi crystalline, melt processable copolyamides, producible by condensation of terephthalic acid, adipic acid, C36 dimerized fatty acid with trimer content of 1-35% wt of tribasic acid (see Column 5, line 30).

As evidenced by Uang, mechanical properties of dimerised fatty acid-based polyamide is greatly affected by the nature of the acid (i.e. ratio between monomeric, dimeric, trimeric and polymeric fractions (see line 0044)). In addition Uang discloses that the above polyamides have a lower degree of crystallinity compare to Nylon 6,6. This phenomena occurs due to molecular weight difference between adipic and dimerised fatty acids (C6 vs C18) and molecular weight distribution of commercial fatty acids.

Large fragments of Tribasic fatty acid (C54) decreases melting point of a polyamide, creates irregularities in crystalline structure and eventually decreases such mechanical properties as toughness (Young Modulus).

High melting point (in the case of instant Application  $T_m$  is around 300C suggests high degree of crystallinity. Therefore, the melt processing of such resin is very challenging. One of ordinary skills in the art knows that crystallinity depends on regularity of fragment recurrence in polymer chain. Introduction of third long monomer inevitably decrease crystallinity degree (lowering  $T_m$ ), Improving processing, but decreasing toughness of the polyamide. The balance between processability and mechanical properties (i.e. toughness) can be established based on the requirements to the final polymer article.

It would have been obvious to a person of ordinary skills in the art at the time the invention was made to use distilled fatty acid mixture with trimer content below than 3%wt in polyamide synthesis in order to obtain more regular structure of the polymer, increasing its toughness.

Addition of dimerized fatty acid decreases its melting point, which leads to better processability. Compare to adipic acid as a melting point regulator, dimerized fatty acid has an advantage, since molar amount of fatty acid needed to achieve the same result is much lower due to the difference in their molecular weight.

Therefore, it would have been obvious to a person of ordinary skills in the art at the time the invention was made to use dimerized fatty acid in Nakamura's polymer to enhance processability of the polyamide.

## Issue II

Claims 6, 8, 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura in combination with Frihart and Coquard 1 (US patent 4680379) or Coquard 2 (US patent 4826951) or Drawert ((JP publication 05-12584) (cited in the previous Office Action).

Nakamura teaches semi-crystalline, melt processable copolyamides comprising terephthalic, isophthalic (Column 2, line 55), C6-C12 aminocarboxylic acids or lactams ((column 3, line 25), C6-C12 dicarboxylic acids (column 3, line 10), C4-C12 diamines (Column 3, line 5) with melting point from 290C to 316C (Abstract). Variations in melting point values can be achieved by changing ratios between aromatic and aliphatic fragments of the resin. Melting point of the polyamide varies by changing ratio between aromatic (i.e. phthalic) and aliphatic (i.e. adipic) acids in the composition. (see discussion above).

Frihart discloses semi-crystalline, melt processable copolyamides, producible by condensation of terephthalic acid, adipic acid, C36 dimerized fatty acid with trimer content of 1-35% wt of tribasic acid (see Column 5, line 30). (see discussion above).

Nakamura and Frihart don't teach terephthalic and isophthalic acids presented together in the mixture.

Coquard 1 or Coquard 2 or Drawert disclose a mixture of isophthalic and terephthalic acids in their polyamides.

Drawert discloses semi crystalline, melt processable copolyamides, producible by condensation of terephthalic acid or its mixture with isophthalic acid or aliphatic C 4-11 acid (Abstract, lines 0019, 0020, 0021 ), adipic acid, dimerized fatty acid (dimerized C12-22 carbon fatty acid, line 0023) and aliphatic diamines (i.e. hexamethylenediamine or diaminononane (Abstract, line 0030).

Coquard 1 discloses semi crystalline, melt processable copolyamides, producible by condensation of terephthalic acid or its mixture with isophthalic acid, adipic acid, dimerized fatty acid (for instance dimerized C18 fatty acid, Column 5, line 65) and aliphatic diamines (i.e. hexamethylenediamine) (Abstract, Claims 9 and 20).

Coquard 2 discloses semi crystalline, melt processable copolyamides, producible by condensation of terephthalic acid or its mixture with isophthalic acid or aliphatic C12 acid (Column 5, line 50), adipic acid, dimerized fatty acid (for instance, dimerized C16-20 carbon fatty acid, Column 6, line 10) and aliphatic diamines (i.e. hexamethylenediamine) (Abstract).

Mixing terephthalic acid with isophthalic acid is a one of the methods to affect crystallinity (and subsequently, melting point) of a polyamide. Excessive amount of



Art Unit: 1700

terephthalic acid leads to high crystalline structure, which should be processed at very high temperature.

Therefore, it would have been obvious to a person of ordinary skills in the art at the time the invention was made to use mixture of terephthalic acid with isophthalic acid in Nakamura's polymer to enhance processability of the polyamide.

### **(10) Response to Argument**

#### **Response to Arguments for Issue I**

The Appellant argues that Uesaka, cited in the Advisory Action, mailed on November 23, 2007 for evidence purposes can not be found in previous Office Actions. The Examiner meant Uang et al (US 2003/0126788), cited in the Final Office Action, mailed on 8/08/2007.

The Appellant argues that the Office has failed to present a prima facie case of obviousness. More specifically, the Office has failed to set forth the information required in a proper obviousness determination (i.e., "a Graham factor analysis"). In particular, Appellant stated that the Office Action does not recite the differences between the claimed invention and the prior art (the second factor). For example, it is not clearly acknowledged in the Office Action that Uang et al. and Frihart et al do not disclose all of the elements of the present invention.

The Examiner disagrees. The primary reference used for rejection under 35 USC 103(a) is Nakamura. In the Rejection, Examiner stated that Nakamura does not teach dimerized fatty acid in his polyamide.

Frihart teaches the same class of polyamide, since it comprises all the major ingredients of Nakamura's material. Frihart teaches dimerized fatty acid in his polyamide.

Regarding Uang, as stated by Examiner in the Final Office Action, this Reference applies for evidence purposes only. Uang discloses the difference between polyamides, based on adipic acid, having 6 carbon atoms and dimerised fatty acid with 36 carbons at the same diamine structure (i.e. hexamethylene diamine).

The person of ordinary skills in the art (3-rd Graham's factor) suppose to know the following basic principles of Polymer Chemistry as they apply to polyamides:

1. Polymers with high toughness (measured by Young Modulus), rigidity and tensile stress at break typically have low elongation at break (flexibility).

2. High melting point (in the case of instant Application  $T_m$  is around 300C suggests high degree of crystallinity. Therefore, the melt processing of such resin is very challenging. One of ordinary skills in the art knows that crystallinity depends on regularity of fragment recurrence in polymer chain. Introduction of third long monomer inevitably decrease crystallinity degree (lowering  $T_m$ ), Improving processing, but

decreasing toughness of the polyamide. The balance between processability and mechanical properties (i.e. toughness) can be established based on the requirements to the final polymer article.

3. Mechanical strength of a polyamide depends on concentration of NHCO amide bonds, which form intermolecular Hydrogen bonds. It is clear that when concentration of such bonds is lower at the same nature of monomer (aliphatic or aromatic), the strength of polyamide decreases. Since dimerised fatty acid have a significantly higher molecular weigh compare to adipic acid (C36 vs C6), the amount of H-bonds in polyamide based on fatty acid is lower, which decreases strength and toughness, but increases flexibility of the polymer.

Therefore, Uang's findings regarding differences of physical properties for polyamides based on C6 and C36 acids are completely within the knowledge and understanding of ordinary artisan. Uang simply illustrates the above in his example.

The Appellant argues that the Office also fails to point out that Frihart et al. describes a functionalized polyamide that is different than both the present invention and Uang et al. Specifically, Frihart et al. describes an acrylate-modified aminoamide resin, which contains at least one acrylate or methacrylate group.

However, Frihart teaches that the polyamide should have good mechanical strength (toughness), flexibility and heat resistance (see Columnn1, line 25), which determined by the structure of the main chain of Frihart's polyamide. It is well known that polyamide containing significant amount of terephthalic acid having better mechanical strength and heat resistance than polyacrylates.

The Appellant states that with respect to the Graham factors, the Office also fails to define the level of ordinary skill in the pertinent art (the third factor) and fails to provide an appropriate explanation of why the consideration of the Graham factors results in the Office's conclusion that the claimed invention would have been obvious to one of ordinary skill in the art in view of the cited references.

The level or ordinary skill in the pertinent art is defined in the above discussion.

The Appellant argues that he did not find the alleged disclosure "(i.e., ratio between monomeric, dimeric, trimeric and polymeric fractions in line 0044. On line 0044 Uang discloses that dimerised fatty acids normally represent a mixture of monomeric, dimeric and polymeric species. The physical properties of polyamides of this type are determined to a large extend by the identity of dimer acid used in their production.

In course of the above discussion it was shown how of the monomer's molecular weight influences the mechanical properties of the polyamide. It also shown that

introduction of addition monomer with different molecular weight affects crystallinity of the polyamide. Content of monomeric and trimeric fatty acid mixtures in fatty acid dimer clearly introduces both above factors.

The Appellant argues that the Office ignores the fact that Uang et al. describes a different category of polyamide than that of the present invention. Again, Uang cited in the Rejection solely for the purposes to show how dimerised fatty acid affects the physical properties of the polymer.

The Appellant states that " In the present invention, copolyamides with dimerised fatty acids increased toughness". The Examiner does not understand this statement. It is clear that claimed polyamides have good toughness, since their melting point is around 300C. However, based on common scientific assessment., introduction of dimerised fatty acid cannot increase toughness (see discussion above).

### **Response to Arguments for Issue II**

The Appellant does not present any arguments regarding Coquard 1, Coquard 2, and Drawert references.

### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

Art Unit: 1700

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/GL/

Conferees:

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